Midterm Examination 1
CS170: Introduction to Computer Science

Observe the Emory College Honor Code while taking this test.

Question 1. (30 pts)

1. What is the function of a **compiler** ?

   Translate a program in a high level language into machine language.

2. What is the command used to compile a Java program named `MyProg.java`

   javac MyProg.java

3. What determines the encoding method used to interpret a number stored in a variable ?

   the type of the variable

4. Give 3 types of statements in Java that we have learned so far.

   assignment statement, if-statement, if-else-statement, switch-statement

5. What is used in Java to contain methods ?

   A class

6. Give 3 things in a Java program where you use an identifier to identify them ?

   Classes, Methods, Variables

7. What is casting ?

   Converting one data type into another type.

8. Give 3 comparison operators in Java

   $==, !=, <, <=, >, >=$

9. Give 3 logical operators in Java

   !, &&, ||

10. What is a Boolean expression ?

    A logical expression or An expression that evaluates to `true` or `false`

Question 2. (30 pts)

Suppose you are given the following variable definitions:

```
int    i = 1,   j = 2,   k = 3;
double a = 1.0, b = 2.0, c = 3.0;
String s = "abc";
```

Recall that an **expression** in Java returns a number and each of the assignment operator
=, +=, -=, ... in Java returns a number.

For each of the following expression below,

1. State whether it is a legal expression in Java (i.e., the Java compiler will not report
   an error)

2. If the expression is legal, give the result of the evaluation of the expression (**do not**
   evaluate the expression if your answer is "not legal")

Use the *original values* given above to answer each individual question below.

Expressions:

1. `a + i`

   Legal: yes   if legal, result = 2.0

2. `a = ++i + 4.0`   (Note: use the *original value* of i = 1 !)

   Legal: yes   if legal, result = 6.0

3. `(a = ++i) + 4.0`

   Legal: yes   if legal, result = 6.0

4. `10/k`

   Legal: yes   if legal, result = 3

5. `10.0/k`

   Legal: yes   if legal, result = 3.333333333

6. `10%k`

   Legal: yes   if legal, result = 1

7. `s < a`

    Legal: no

8. `s + i + j`

    Legal: yes   if legal, result = abc12

9. `s + i - j`

    Legal: no

10. `i + j + s`

    Legal: yes   if legal, result = 3abc

Question 3 (20 pts)

The method `Math.random()` in the Java's library returns a random number between (0,1).

The method `Math.max(x, y)` in the Java's library returns the maximum of two values `x` and `y`.

Complete the following Java program, that prints the largest of 5 randomly generated values.

```java
public class Question3
{
   public static void main( String[] args )
   {
      double a = Math.random();
      double b = Math.random();
      double c = Math.random();
      double d = Math.random();
      double e = Math.random();

      double largest;

      // Hint: do not nest the Math.max() method calls - if you
      //       nest 5 calls, the logic will become too difficult
      //       to handle.
      //
      // Complete the program here:


      largest = Math.max(a , b);
      largest = Math.max(largest , c);
      largest = Math.max(largest , d);
      largest = Math.max(largest , e);

      System.out.println("The maximum of the 5 numbers = " + largest);
   }
}
```

Question 4 (20 pts)

In homework 3, you have program the "Rot13" encoding method. Here is the solution for your reference:

```java
public static char rot13(char c)
{
    if (c >= 'a' && c <= 'm' || c>='A' && c<='M')
    {
      // These letters need to shift right 13 places
      return (char) (c + 13);
    }
    else if (c >= 'n' && c <= 'z' || c>='N' && c<='Z')
    {
      // These letters need to shift left 13 places
        return (char) (c - 13);
    }
    else
    {
       // don't shift non-letters - return c unchanged.
       return c;
    }
}
```

Julius Caesar used a much simpler code to transmit his military orders which I will call the "Shift3" code: every character is shifted 3 position further in a *round robin* manner (i.e., the letters "rap around").

Here is a table of the mapping of the letters:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklmnopqrstuvwxyz
|             |            |
v ...         v            v ....
DEFGHIJKLMNOPQRSTUVWXYZABC defghijklmnopqrstuvwxyzabc
```

Question:

Write a Java method `Shift3` that returns the "Shift3" character for an input character `c`.

Use the next page for your answer.

```java
public class Question4
{
    public static char shift3(char c)
    {
        // Method returns the "Shift3" character for the input c

        if (c >= 'a' && c <= 'w' || c>='A' && c<='W')
        {
            // These letters need to shift right 3 places
            return (char) (c + 3);
        }
        else if (c >= 'x' && c <= 'z' || c>='X' && c<='Z')
        {
            // These letters need to shift left 23 places
            return (char) (c - 23);
        }
        else
        {
            // don't shift non-letters - return c unchanged.
            return c;
        }
    }
}
```